DOCUMENT RESUME

ED 108 938 SE 019 182

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TITLE Careers in Physics.
INSTITUTION B'nai B'rith, Washington, D.C. Vocational Service.
REPORT NO BBCCS-Pamphlet-1016
PUB DATE 72
NOTE 21p.
AVAILABLE FROM B'nai B'rith Career and Counseling Services, 1640 Rhode Island Avenue, N. W., Washington, D. C. 20036

EDRS PRICE MF-$0.76 HC-$1.58 PLUS POSTAGE
DESCRIPTORS *Career Education; *Occupational Guidance; Physical Sciences; *Physics, Professional Education; *Science Education; Scientists; *Vocational Counseling

ABSTRACT

This publication, a pamphlet included in the B'nai B'rith Occupational Brief Series, directs its attention to the personal traits and interests that a young person should possess to undertake serious study of physics. The nature of the science of physics is briefly presented, as well as the nature of the physicist. The subject matter of physics is described and a list of subfields is included. Careers in physics teaching, research, and administration are considered as three categories into which physicists fall. It is pointed out that the study of physics can also be used as a springboard to careers in other fields and presents several examples. Educational preparation and counseling services are presented. Factors related to job opportunities, salaries received, and employment outlook for men, women, Jewish and other minorities are reviewed. A selected bibliography is presented. (EB)

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careers in physics

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Published by B'nai B'rith Career and Counseling Services
Formerly – B'nai B'rith Vocational Services

Under the Editorship of
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CAREERS IN PHYSICS

by WILBUR V. JOHNSON
Executive Officer
American Association of Physics Teachers

INTRODUCTION

PHYSICS IS AS OLD as man's curiosity in the inanimate world around him. It began with observation of heavenly bodies—the stars, moon, and planets. The repeated cycling of the moon through its phases, the observed motion of the stars during the night, the changing positions of the moon and planets—these were noted carefully and remembered.

But then a few men began to wonder about what they saw. Why do these things occur? What must the world be like for us to see what we do? This brought imagination and speculation into play. Someone suggested that a great transparent globe surrounded the earth and that points of light were stuck to it. This globe was thought to spin steadily around the earth, thus accounting for the observed motion of the stars. Of course, our "explanation" today is quite different.

NATURE OF PHYSICS

OBSERVATION AND SPECULATION—seeing something and asking why—these are the essence of all sciences. Physics is the most basic and fundamental of these. It is concerned with the nature of matter itself. Physicists strive to unravel the ultimate mysteries of

the stuff from which the universe is made. Because of its fundamental character, physics has contributed much to many fields as well. Dr. Edward M. Purcell, co-winner of the 1952 Nobel Prize in physics, summed it up this way in a recent interview:

"Ever since the dawn of history, experimenters have been driven by an unquenchable curiosity to solve the mysteries they saw in nature. 'Why do these things happen?' they asked. 'And how do they happen?' The answers they discovered—fundamental truths about matter, energy and motion—make up physics, man's basic science.

"Why atoms stick together is physics—and so physics underlies the science of chemistry. Why stars shine is physics—so physics is the key to understanding astronomy. Engineering and in fact practically all of modern technology, is based on physics.

"Physicists formulated the principles that opened the way to the development of radio, radar, the electron microscope and the computer. They discovered X-rays, cosmic rays and radioactivity. They probed the core of the atom to discover the structure of the nucleus and the laws that govern matter in that domain.

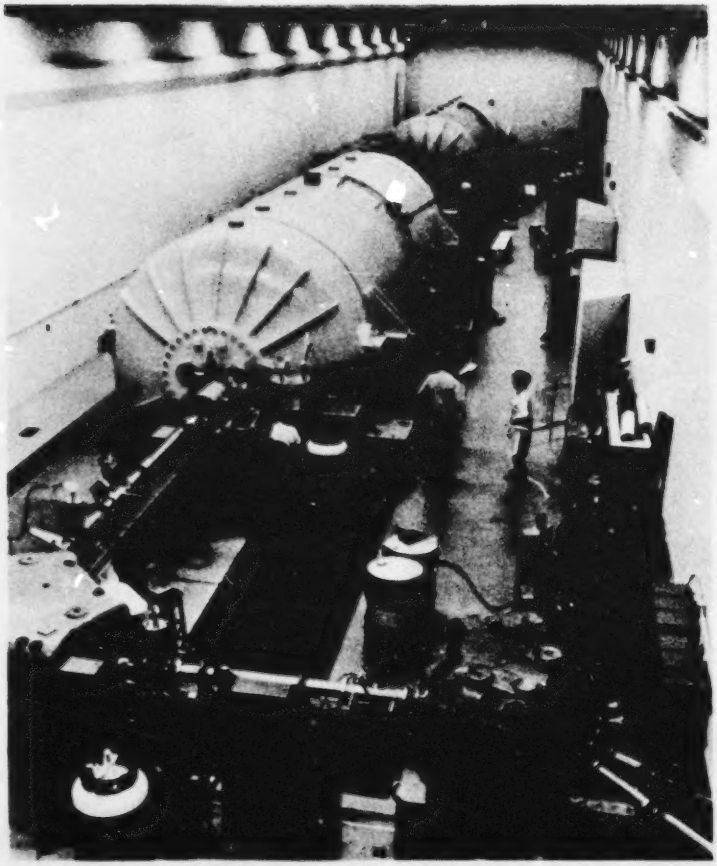
"Physics provided many of the basic theories and physicists most of the devices that made it possible for man to vault safely into space and land on the moon. Besides ideas, physics has also contributed tools—the mass spectrograph, Geiger counter and X-ray diffraction, for example—that have profoundly affected research in other sciences." [40]

NATURE OF PHYSICISTS

WHAT ARE THE PERSONAL traits and interests that a young person should possess to undertake serious study of physics? Drawing on his experience as a renowned teacher and researcher, Dr. Purcell also answered this question:

"I must stress that physics is a demanding, highly competitive profession and that only young people with a genuine intellectual interest in the science and the world around them are likely to be happy and successful in it. Those attracted mainly by the glamor, excitement, and prestige are better off elsewhere.

"Honest answers to the following can give you some idea if you possess the essential personal qualifications: Does science fascinate you? Are you at home with abstract ideas? Do you have a strong curiosity about how things work? Do you enjoy tackling new problems and think them through clearly and



The University of Washington Nuclear Physics Laboratory: Overview of the Tandem Van de Graaf Accelerator.

University of Washington, Seattle, Wash.

logically, seeking to solve them with experimental ingenuity?

"Do you enjoy puzzles?—most physicists I know have always been fond of them and still are! Do you enjoy explaining things? Maybe you will make a fine science teacher.

"How about girls? There are far too few in the field—only three percent. Many girls are keen-minded and inquisitive, and would make first-class physicists. Many women have found successful careers in the profession and a number of them have distinguished themselves. We need more women in science, and I hope more of them will find their way in through physics." [41]

CONTENT IN PHYSICS

THE SUBJECT MATTER of physics is rich and varied, as described in the following words of Dr. Purcell:

> "The scope of physics is widening constantly. Research, proceeding at an incredibly rapid pace, has opened new doors to a wide variety of intriguing specialties. For example: Solid state physics has given us the transistor, micro electronics and the solar battery, and promises much more. Astrophysics studies the stars and space physics the vast area between them and the earth. Nuclear physics is the basis for atomic energy and for applications of radioactivity in chemistry and medicine. Chemical physics (pretty close to physical chemistry) studies the forces between molecules. Through biophysics and medical physics the tools and ideas of physics are brought to bear on the mechanism of life and the treatment of disease Low temperature physicists study the weird behavior of matter near absolute zero and are finding astonishingly practical applications. Optics and optical engineering include work with the amazing intense-light laser beams, infrared devices and lensless photography." [42]

To his list might be added the following subfields:

Acoustics, the science of sound, including underwater transmission, shock waves, and ultrasonics.

Crystallography, the study of the internal arrangement of solids.

Elementary particle physics, concerned with the nature of the fundamental constituents of matter.

Plasma physics, some of whose workers are attempting to reproduce and control on earth the processes responsible for the sun's energy.

Physics has also played an important role in such related fields as astronomy, cosmology, electronics, geophysics, meteorology, oceanography, and physical chemistry.

CAREERS IN PHYSICS TEACHING

WHAT DOES A physicist do? There are many answers to that question. They generally fall into three categories: teaching, research, and administration.

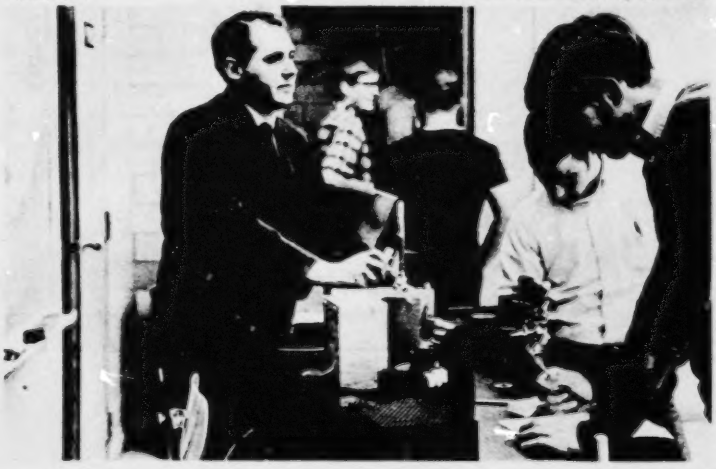
Below the junior high school level, physics is seldom taught as a separate course but is included in classes on science. It is, therefore, rare to find an elementary school teacher identifying himself as a physicist. Most junior high schools offer classes in physical science. These are sometimes taught by a physics teacher. A senior-

level class in physics is offered by many high schools. Many changes in both curriculum and teaching technique at these levels have recently been suggested and are now being adopted. Young people who enter these teaching fields in the near future may share the excitement and satisfaction of putting them to use.

A relative newcomer to American education is the two-year college (junior college and community college are alternate names). Most of these offer physics courses and employ teachers of physics. Many of the courses are similar to those taught at other institutions of higher education. There is, in addition, one category offered only at two-year institutions. These are the classes to be taken by students preparing for such careers as x-ray technician, dental assistant, and engineering aide. They are relatively new fields. Suitable course materials for them simply do not yet exist. A young person choosing this area for a teaching career can find considerable opportunity for personal initiative and creativity.

Many physicists are also employed by four-year colleges and universities. Courses taught at this level are often categorized in terms of the students studying them: physics and engineering majors, students planning to specialize in other fields; and individuals without career interest in science. One of the greatest challenges at present for this last group is to develop courses that demonstrate the efforts science and technology can make to solve the problems of the modern world. Considerable thought is also being given to broadening the physics major to prepare its graduates for a wider range of careers. Teaching at this level, as in secondary schools and two-year colleges, can be a very creative and satisfying profession.

Teaching as a creative and satisfying profession: Cherry Creek High School, Englewood, Colorado. The American Association of Physics Teachers



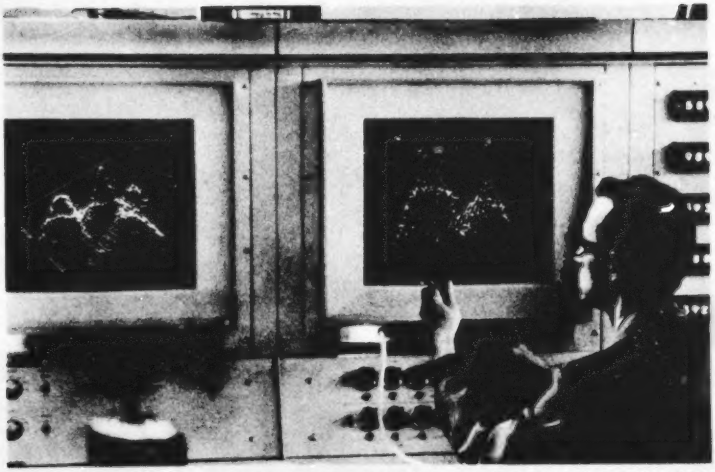
CAREERS IN PHYSICS RESEARCH

MANY PHYSICISTS SPEND their time in fundamental research, attempting to add new information to the science. Some spend much of their time in a laboratory. Here they think up new experiments and then design and build the necessary apparatus. Experimental physics, as this is called, is sometimes done by individuals or small groups. Quite often it is carried on by large research teams. Numerous investigations designed to increase our understanding of matter itself are conducted by such groups using huge particle accelerating machines in university and government laboratories.

Other research physicists hardly ever visit a laboratory but instead essentially do experiments with paper and pencil. They try to create a mental image, or model, of a physical situation. Then they work out the conclusions that necessarily follow from that model. Usually some of these conclusions can be checked by experiments to see if they agree with observed facts. If they do, the model is a useful one and has added to our understanding. If they don't, then other models must be created and new calculations made. This kind of activity, theoretical physics, is very abstract. It requires a thorough understanding of advanced mathematics.

Although they appear quite different in nature, experimental and theoretical research generally proceed in step with each other. Many large research teams contain some theoreticians and some experimentalists. Both groups work together on the same general problem. Each individual contributes from his own experience and knowledge to the project. Research like this, performed solely to increase our knowledge about and understanding of nature, is designated basic or fundamental research. Although some is done in government and industrial laboratories, most of it is carried out at universities. Its practitioners often teach as well. In this way, they combine two creative activities into a single career.

Another area of research, equally creative but quite different in its purpose, is usually designated applied research or development. It is directed toward problem solving and development of techniques and procedures. In this way it differs from basic research. It has specific short-range objectives other than creating new knowledge for its own sake. Much research activity in industrial laboratories, which is aimed at producing new and improved products, fits this category. Recent efforts to reduce the problems of environmental pollution are another example. In general, knowledge and techniques of basic research are applied to find practical solutions to existing problems. Both theoreticians and experimentalists play a role in applied research and development, much as they do in



The University of Washington Nuclear Physics Laboratory: Operating the on-line data-collection computer. University of Washington, Seattle, Wash.

fundamental research. Even when the subject matter of physics is not deeply involved, the attributes of a research physicist are very useful.

CAREERS IN ADMINISTRATION

A THIRD GENERAL career catego· y for physicists is administration. Most of these positions exist in conjunction with the types of employment already described. Some physicists at universities and colleges, after a successful career in teaching and research, become deans, vice-presidents, or presidents. Directors of research in university, government, and industrial laboratories have often begun their careers as research specialists. It is not uncommon also to find business executives in technically oriented corporations who have extensive experience in applied research and development. Numerous foundations and agencies, both private and federal, that are involved with science offer administrative careers to individuals with experience in academic or industrial physics.

OTHER CAREERS

THERE ARE MANY other industrial jobs that physicists can perform capably. Sometimes these are related to research or development projects, but often they are not. Assembling, testing, and main-

taining apparatus is one such task. "Trouble shooting" on production assembly lines is another. Assignments such as engineering aides, computer programmers, and systems analysts are frequently accepted by physicists. Monitoring radiation standards and sampling manufactured products for quality control are other examples. Wherever technical problems exist, individuals with backgrounds in physics can help to solve them.

The study of physics can also be used as a springboard to careers in other fields. Of course this is obvious in such closely related areas as astronomy and geophysics. The medical sciences, patent law, the environmental sciences, the history of science, and science writing also offer careers to individuals with some training in physics. In fact, the study of physics as one of the "liberal arts" can be a valuable component in almost any career. Science and technology will continue to play a dominant role in modern life. Thus, they will remain of great importance to people in all walks of life.

NUMBER OF PHYSICISTS

POSITIONS ARE AVAILABLE in either teaching or research for individuals with varying amounts of college work in physics. Naturally, starting salaries and the degree of independence and responsibility in the position increase with the amount of educational background. Each level of teaching position also has a rather specific degree requirement for prospective teachers.

In the spring of 1971 the National Science Teachers Association identified over fifteen-thousand high school physics teachers. Many of these also teach courses other than physics. The usual academic background required is a bachelor's degree with a major emphasis in one field and a minor concentration in another. Mathematics is a particularly attractive second field for physics teachers. Either chemistry or biology is also appropriate. In addition, the potential teacher must meet the certification standards of the state in which he hopes to teach.

At the two-year college level there are perhaps two thousand active physics teachers. A master's degree in physics is now generally recognized as the minimum preparation necessary to obtain such a position. Some states, in addition, have certification requirements. Completion of requirements for the master's degree generally takes one to two years beyond the bachelor's degree.

Approximately twelve-thousand physicists are employed by four-year colleges and universities. It is very rare for newly appointed members of these physics faculties not to have their doctorates. Anyone seriously contemplating such a career must plan approximately five years of intensive study in physics after

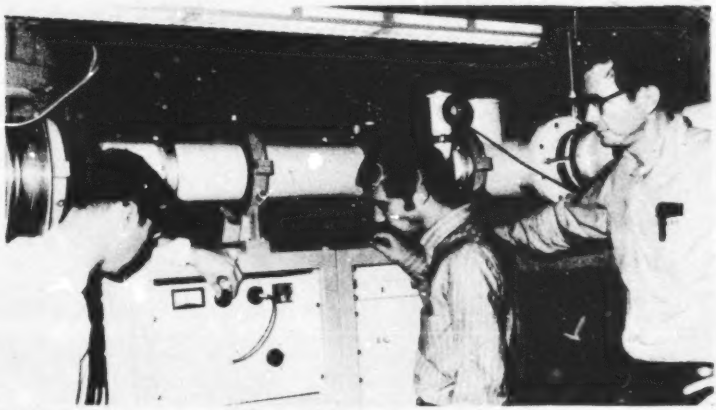
receiving his bachelor's degree. A major part of this graduate study is devoted to research activity and preparation of a dissertation. In the last year or two several leading institutions have questioned the appropriateness of intensive research activity as preparation for college teachers. As a result, new programs with more emphasis on cultivating teaching skills and less on developing research abilities are being instituted. It must be emphasized that these programs are new and that their acceptability is still to be established. A young person just now beginning a decade of study in preparation for a college teaching career should certainly watch these developments carefully before selecting a particular advanced degree program.

Private industries employ about twelve-thousand physicists. The federal government and non-profit organizations provide work for another six-thousand personnel. About 40 percent of industrial physicists have doctorates, 30 percent master's degrees, and 30 percent the bachelor's degree. The three degrees are represented almost equally among physicists employed by the government. It is interesting to note that almost equal numbers of physicists work in private industry and in four-year colleges and universities.

EDUCATIONAL PREPARATION

THE MOST DESIRABLE high school preparation for a career in physics is independent of the particular occupational objective. These studies should be broadly based but with a good concentration of science and mathematics courses. A serious student will elect one course in science and another in mathematics each year. He will also find useful several years' study of one modern foreign

Educational Preparation: Kansas State University.



language. Finally, if courses in advanced physics or computer programming are available, they make very worthwhile electives.

At the same time, serious attention must be given to humanities and social sciences. Courses in English composition and speech are important to assist the student in gaining skill in both oral and written communication. Knowledge of the arts and literature can enable him to use his leisure time wisely and creatively. Some familiarity with the social sciences is almost mandatory in today's increasingly complex society. Failure to complete this entire program in high school is not an insurmountable obstacle since deficiencies may be removed in college. Too many deficiencies, however, may lengthen the time required to complete the desired college program.

Each student should consult with his high school counselor to ensure satisfaction of additional requirements imposed by the college he will attend. Once enrolled there he will find departmental advisors available to assist with planning his program. It will certainly include concentrated study of physics and mathematics. The details will depend on whether he ultimately chooses a career in teaching, in research, or in both. If high school teaching is his objective, he will take education, psychology, and student teaching instead of some advanced physics courses. Preparation for a career in college teaching may include similar courses. This will be particularly true if the new graduate programs mentioned previously prove effective and acceptable. Perhaps the best advice a student can accept is to keep his career objectives as flexible as possible in order to react positively to changing economic factors.

COUNSELING

MANY YOUNG PEOPLE find educational and vocational counseling helpful in choosing an appropriate and satisfying career. Anyone interested in assessing his assets and limitations in relation to a career as a physicist should consider the counseling services in his own school or those of a professional counseling service. Especially suitable are the field offices of the B'nai B'rith Career and Counseling Services and any local counseling agency approved by the American Board on Counseling Services. A list of these agencies is published in a DIRECTORY OF APPROVED COUNSELING AGENCIES. This directory is available in many school and public libraries.

FINANCIAL ASSISTANCE FOR STUDENTS

MANY SOURCES OF FINANCIAL ASSISTANCE in the form of scholarships, fellowships, and loans are available to serious college students, both undergraduate and graduate. Lack of personal funds should not discourage a student with career interests in physics

from attending college. A major student reference source providing information about student aids is SCHOLARSHIPS, FELLOWSHIPS AND LOANS, authored by Dr. S. Norman Feingold and published by the Bellman Publishing Company. This company also issues the SCHOLARSHIPS, FELLOWSHIPS AND LOANS NEWS SERVICE, a quarterly newsletter devoted to reporting new developments in student aid funds as they are established. Many colleges have Financial Assistance offices which can also be very helpful in this regard.

Most physics departments have student positions available. Particularly in colleges without physics graduate programs, junior and senior physics majors often serve as teaching assistants, research assistants, and stockroom managers. Although pay is modest, it does help offset the costs of attending college. Furthermore, these positions bring the student into a close relationship with his professors. The work may give him a first-hand impression of what a career in physics is really like. Departments with a major graduate program generally have a number of teaching and research assistantships. These are intended to support students during their years of graduate study. Application for them is usually made simultaneously with application for admission to the graduate program.

SALARIES

THE AMOUNT A PHYSICIST EARNS depends very much on the nature of his employment, his educational background, and his work experience. Starting salaries in 1970 for high school physics teachers who had just received bachelor's degrees averaged $7000–$7500. At the same time, their classmates who accepted appointments in industry or government began at about $10,000 per year. The relatively small fraction of this group who took positions with colleges or foundations received average salaries of $7500–$8000.

Beginning salaries for high school teachers generally increase about $600 for each year of study beyond the bachelor's degree, up to a maximum of three years. Thus, with a master's degree (or five years of college study), a new high school teacher may earn $7500–$8000. With a doctorate he can expect $8500–$9000. Incidentally, many high school science teachers have advanced degrees in education or one of its subfields rather than in a scientific specialty. Starting salaries in industry and government average about $12,000 for the holder of a master's degree and about $15,000 for an inexperienced physicist with a doctorate degree. The corresponding figures for a beginning college or university instructor are, perhaps, $9,000 with a master's and $12,000 with a doctorate degree. These last figures are only estimates. There is considerable variation in salary schedule from one institution to another.

Every second year the federal government supports a survey of U. S. scientists to determine their salaries and other characteristics. The median salaries for physicists in 1970 are shown in the following tables: [36]

Type of Employment	*Number of Individuals*	*Median Salary*
Total, All Employers	36,336	$15,900
Educational Institutions	18,085	13,500
Federal Government	3,912	17,400
Other Government	101	12,100
Non-profit Organizations	902	18,000
Industry and Business	9,819	18,000
Self-Employed	285	20,000
Military	763	–
Other	60	8,200
Employer not Reported	293	–
Unemployed	2,116	–

Primary Work Activity	*Number of Individuals*	*Median Salary*
Research and Development	17,544	$16,200
Management or Administration	5,460	22,100
Teaching	8,418	14,000
Production and Inspection	240	15,000
Consulting	412	18,700
Exploration, Forecasting, Reporting	775	13,500
Other	377	15,800
Activity not Reported	994	16,700

Highest Degree	*Number of Individuals*	*Median Salary*
Doctorate	16,637	$17,300
Master's	12,215	14,100
Bachelor's	7,392	14,600
Degree not Reported	92	13,800

Remember that these are median salaries: half the people in each category earn more; the other half less. The actual range in salaries is illustrated by noting that in 1970 ten percent of the physicists reported earned less than $10,000, while the top ten percent earned more than $25,000.

In perusing these tables the reader should be aware that the figures are compiled from questionnaires returned by individual

physicists. Since not everyone responds, the actual numbers of physicists are somewhat greater than shown. In particular, many high school physics teachers identify with other disciplines. Their salaries are not included in these tabulations.

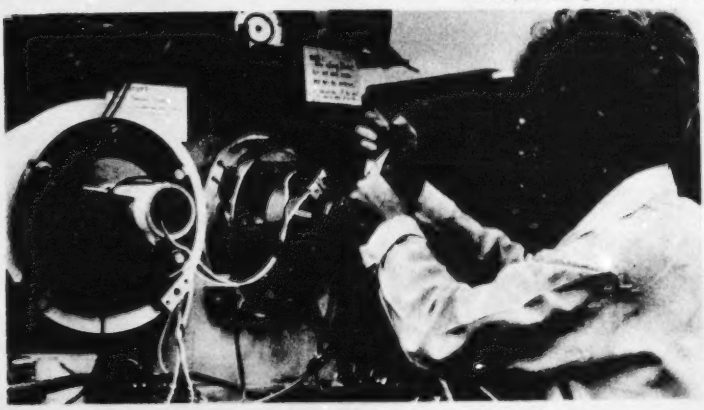
FINDING A JOB

ONE STRAIGHTFORWARD WAY TO FIND the first job is to work through a College Placement Office. School districts send representatives to the campus to interview prospective high school teachers. The same has been true of industrial and government laboratories. Interviewers talk to graduates at all degree levels. The placement services of most institutions remain available to their alumni throughout their working careers.

For the bachelor's degree candidate who wishes to go on to graduate school, and for advanced degree students who hope to take positions on college or university campuses, procedures are a bit different. Regarding these openings, physics departments throughout the country generally communicate among themselves. The student, therefore, should contact the appropriate faculty or staff member in his own department for information and advice.

The American Association of Physics Teachers is one of several leading physics societies that cooperated to establish the American Institute of Physics. This agency provides a number of services needed jointly by all the societies. One of these is the physics Placement Service. It maintains lists of available positions of all types. These may be examined free of charge by anyone seeking a physics position. The Placement Service also

The University of Washington Nuclear Physics Laboratory: Adjusting the ion source.
University of Washington, Seattle, Wash.



maintains files of qualification sheets filled out by job applicants. Four times each year these sheets are compiled into books and made available to prospective employers. For the benefit of students and teachers a list of summer jobs is also prepared annually. Additional information may be obtained from the American Institute of Physics, 335 East 45th Street, New York, N.Y. 10017.

OPPORTUNITIES FOR JEWISH AND OTHER MINORITY GROUP YOUTH

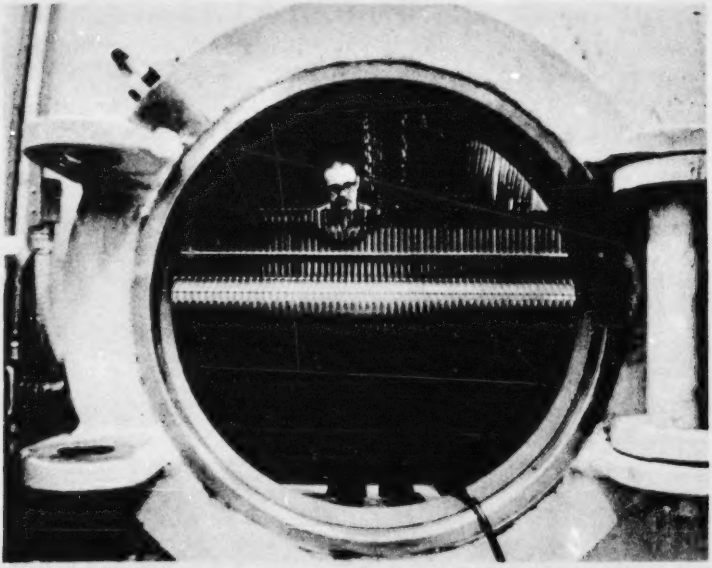
TODAY, IN THE FIELD OF PHYSICS, there are intensive efforts to seek out and employ members of minority groups, to establish training programs and to make scholarships and loans available.

Religious or minority group discrimination in physics is the exception rather than the rule. This is due primarily to the combined efforts of professional counselors assisting youth today. Enlightened business communities, the work of civil rights agencies like the Anti-defamation League of B'nai B'rith, and the enactment of federal, state and local anti-discrimination laws have all contributed to make this an attractive and non-discriminatory profession.

IN COLLEGE AND CAREER PLANS OF JEWISH HIGH SCHOOL YOUTH, a research study conducted by the B'nai B'rith Career and Counseling Services in cooperation with B'nai B'rith Women, approximately 75 percent of the boys surveyed indicated they hoped to enter professional and technical occupations. Another 7 percent selected executive, managerial and administrative occupations. More than 75 percent of the girls surveyed hoped eventually to enter professional or technical occupations. Thus, many Jewish youth are headed toward occupational categories that include the field of physics.[46]

EMPLOYMENT OUTLOOK

DURING THE TEN OR TWELVE YEARS following the start of the space age in the late 1950's, U. S. science, including physics, flourished. A serious effort was made to increase the quality and quantity of research physicists. The latter's success is now painfully obvious. For the first time in many years, new physics Ph.D.'s find it difficult or impossible to find positions. The supply of well-trained talent now exceeds the demand. This may be due somewhat to the recent economic downturn, but that is only one



The University of Washington Nuclear Physics Laboratory: At work on the internal high voltage column structure. University of Washington, Seattle, Wash.

contributor. A major factor is simply that the country is now producing more graduate physicists than it can use.

A similar situation may be developing for prospective high school teachers. Although high school science teachers have been in demand, the number of new college graduates prepared to teach a science has increased fairly steadily from the mid-1950's until the present. Indeed, the group expected to graduate in 1970 was unusually large. In estimating 1970 demand for natural and physical science teachers, the National Education Association judged them to be in "low supply." Opportunities remain good in this area, but close attention must be given to possibly changing trends.[34]

What does this mean for the capable high school student with serious interest in physics? Should he avoid the field completely? No, for two reasons: first, there will always be positions for dedicated, capable people. If physics is his main interest, he would be unhappy not to pursue it. Second, it may be ten years, if he studies for a doctorate, before he first seeks employment. The economic situation then can be quite different from what it is at the present time.

In conclusion, it seems most appropriate to quote some sound advice John W. Gardner gave more than ten years ago:

"On many occasions in the future there will be an imbalance between the number of men trained for a given line of work and the number of jobs available. Attempts will be made to minimize this through accurate forecasts of manpower needs, but experience with such forecasts has been discouraging. The alternative – and the wiser course – is to educate men and women who are capable of applying excellent fundamental training to a wide range of specific jobs.

"Nothing contributes more damagingly to the unemployment of educated talent than rigid specialization and rigid attitudes supporting this specialization. The future is necessarily hazardous for the individual who trains himself to do a specific job, receives an advanced degree for that line of work, and believes that society owes him a living doing it. . . .

"Talented young people should not be misled in these matters. They must not be led to assume that there is always a market for talent. But while the individual must be realistic, all who care about excellence in a society must be vigilant concerning the waste of talent." [30]

SELECTED BIBLIOGRAPHY

1. Acoustical Society of America. *Acoustics and You.* New York, N.Y.
2. American Astronomical Society. *A Career in Astronomy.* Princeton, N.J. 1968.
3. American Institute of Physics. *Graduate Programs in Physics and Astronomy.* AIP Pub. No. R-205. New York, N.Y. 1968.
4. American Institute of Physics. *1968-1969 Graduate Student Survey.* AIP Pub. No. R-2072. New York, N.Y. 1970. Prepared annually.
5. American Institute of Physics. *Physics as a Career.* AIP Pub. No. R-227. New York, N.Y. 1970.
6. American Institute of Physics. *Physics Manpower 1969.* AIP Pub. No. R-220. New York, N.Y. 1969. Prepared Biennially.
7. American Institute of Physics. *Placement Service.* AIP Pub. No. R-136. New York, N.Y.
8. American Institute of Physics. *Student's Guide to Undergraduate Physics Major Departments.* AIP Pub. No. R-214. New York, N.Y. 1969.
9. American Institute of Physics. *The Wise Use of Science.* AIP Pub. No. R-234. New York, N.Y. 1970.
10. American Meteorological Society. *The Challenge of Meteorology.* Boston, Mass. 1969.
11. Bellman Publishing Company. *Scholarships, Fellowships & Loans News Service.* Cambridge, Mass. Quarterly.
12. B'nai B'rith Career and Counseling Services. *Counselor's Information Service.* Washington, D. C. Quarterly.
13. Careers, Inc. *Physicist-Career Brief.* Largo, Fla. 1967.
14. Eisen, Irving. *Careers in Teaching and Education.* B'nai B'rith Career and Counseling Services. Washington, D. C. 1970.
15. Eisen, Irving. *Seven Steps to Finding Your Place in the World of Work: A Guide for Jewish and Other Minority Youth.* B'nai B'rith Career and Counseling Services. Washington, D. C. 1971.

16. Eisen, Irving and Leonard H. Goodman. *A "Starter" File of Free Occupational Literature*. B'nai B'rith Career and Counseling Services. Washington, D. C. 1970.

17. Eisen, Irving and Leonard H. Goodman. *Studying for Success in High School and College*. B'nai B'rith Career and Counseling Services. Washington, D. C. 1968.

18. Feingold, S. Norman. *A Career Conference for your Community*. B'nai B'rith Career and Counseling Services. Washington, D. C. 1964.

19. Feingold, S. Norman. *Counselor's Manual for "How About College Financing?"* American Personnel and Guidance Association. Washington, D. C. 1968.

20. Feingold, S. Norman. "Counselors and Community Resources." Special Supplement to *Counselor's Information Service*, Vol. 25, No. 2. B'nai B'rith Career and Counseling Services, Washington, D. C. May, 1970.

21. Feingold, S. Norman. "Guidance for Gifted Students." Reprinted from the *Occupational Outlook Quarterly*, Vol. 12, No. 1. U. S. Department of Labor. 1968. Available from B'nai B'rith Career and Counseling Services. Washington, D. C.

22. Feingold, S. Norman. "Latest Information on Scholarships in the Space Age." Special Supplement to *Counselor's Information Service*, Vol. 23, No. 2. B'nai B'rith Career and Counseling Services. Washington, D. C. May 1968.

23. Feingold, S. Norman. "New Challenges in Counseling Jewish College Youth." Reprinted from the *Journal of Jewish Communal Service*, Vol. 43, No. 3, Spring 1967. Available from B'nai B'rith Career and Counseling Services. Washington, D. C.

24. Feingold, S. Norman. *Scholarships, Fellowships and Loans*. Bellman Publishing Company. Cambridge, Mass. Vol. III, 1955. Vol. IV, 1962.

25. Feingold, S. Norman. "Vocational Outlook for the 1970's and the 1980's." Special Supplement to *Counselor's Information Service*, Vol. 24, No. 3. B'nai B'rith Career and Counseling Services, Washington, D. C. Sept. 1969.

26. Feingold, S. Norman and Dorothy L. Dahlberg. "A Vocational Resources Directory." Special Supplement to *Counselor's Information Service*, Vol. 21, No. 4. B'nai B'rith Career and Counseling Services, Washington, D. C. Dec., 1966.

27. Feingold, S. Norman, Bella Jacobs and Dora R. Evers. "Student Aid Planning in the Space Age: A Selected Bibliography." Special Supplement to *Counselor's Information Service*, Vol. 26, No. 1. B'nai B'rith Career and Counseling Services, Washington, D. C. Feb. 1971.

28. Feingold, S. Norman and Karen Rose. "Student Aids in the Space Age: Educational Resources For The Handicapped—1971 Revision." Special Supplement to *Counselor's Information Service*, Vol. 26, No. 3. B'nai B'rith Career and Counseling Services, Washington, D. C. Sept. 1971.

29. Feingold, S. Norman and Sol Swerdloff. *Occupations and Careers*. McGraw Hill Book Company, New York, N.Y. 1969.

30. Gardner, John W. *Excellence*. Harper and Row, New York, N.Y. 1960. pp. 42-45.

31. Kaiser, Ronald S. and Benjamin Lasoff. *Scholarships and Other Financial Aids in Minnesota*. Twin Cities B'nai B'rith Career and Counseling Services, Minneapolis, Minn. 1967.

32. Manufacturing Chemists Association. *Sources of Career Information in Scientific Fields, 1971-72*. Washington, D. C. 1971.

33. National Education Association. *Salary Schedules for Teachers, 1970-71*. Research Report 1970 R12, Washington, D. C. 1970.

34. National Education Association. *Teacher Supply and Demand in Public Schools, 1970*. Research Report 1970-R14. Washington, D. C. 1970.

35. National Science Foundation. *American Science Manpower, 1968*. NSF 69-38. Washington, D. C. 1969.

36. National Science Foundation. *Reviews of Data on Science Resources*, No. 19. Washington, D. C. Dec. 1970.

37. National Science Foundation. *Salaries and Selected Characteristics of U. S. Scientists, 1970*. NSF 70-50. Washington, D. C. 1970.

38. National Science Teachers Association. *A Career for You as a Science Teacher*. Washington, D. C. 1966.

39. Optical Society of America. *Your Career in Optics*. Washington, D. C. 1963.

40. Purcell, Edward M. *Should You Be a Physicist?* New York Life Insurance Company. 1970. p. 3.

41. Purcell, Edward M. *Should You be a Physicist?* New York Life Insurance Company. 1970. p. 6.

42. Purcell, Edward M. *Should You be a Physicist?* New York Life Insurance Company. 1970. p. 5.

43. Science Research Associates. *Jobs in Science*. Chicago, Ill. 1970.

44. Scientific Manpower Commission. *Science, Engineering and Related Career Hints*. Washington, D. C. 1971.

45. Scientific Manpower Commission. *Test Yourself for Science*. Washington, D. C. 1971.

46. Swerdloff, Sol and Howard Rosen. *College and Career Plans of Jewish High School Youth*. B'nai B'rith Career and Counseling Services, Washington, D. C. 1964.

47. U. S. Atomic Energy Commission. *Careers in Atomic Energy*. Oak Ridge, Tenn. 1964.

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